REMARKS

Applicants have amended claims 1 and 2 and canceled claim 5, without prejudice or disclaimer. Claims 1-4 are now pending.

In the Office Action, the Examiner has objected to the specification and Abstract; rejected claims 1-5 under 35 U.S.C. § 112, second paragraph, as being indefinite; rejected claims 1, 3 and 4 under 35 U.S.C. 102(b) as being anticipated by Kozodoy et al. (U.S. Patent No. 6,265,727); rejected claims 1, 3 and 4 under 35 U.S.C. § 102(e) as being anticipated by Starikov et al. (U.S. Patent No. 6,608,360); and rejected claims 2 and 5 under 35 U.S.C. § 103(a) as being unpatentable over Kozodoy et al. or Starikov et al. Applicant traverses these objections and rejections, at least for the following reasons.

Applicants have amended the specification and claims by replacing each occurrence of "Kovar glass" with the equivalent term "borosilicate glass." As stated in the last paragraph of the attached page 33 of the photomultiplier handbook, under the heading "Borosilicate glass," borosilicate glass is often called Kovar glass, and Applicants advise that further data on this handbook may be obtained by searching the text string "scipp.ucsc.edu/outreach/internships/2005Internship/Resource/pmt_handbook_complete.pdf" at the Google Internet search engine. In view of the foregoing, Applicants submit that the replacement of the term "Kovar glass" with the term "borosilicate glass" is technically appropriate and, at the same, time, addresses the Examiner's objection to the specification and rejection of claims 1-5 under 35 U.S.C. § 112, second paragraph. Accordingly, reconsideration and withdrawal of the objection to the specification and rejection of claims 1-5 under 35 U.S.C. 112, second paragraph, is respectfully requested.

Applicants traverse the rejections based on prior art at least because the applied references of records do not disclose or suggest any of Applicants' claimed combinations comprising wherein each energy gap of said n-type nitride semiconductor layer and p-type nitride semiconductor layer is equal to or larger than the energy gap of said photoabsorption layer.

As background, but in no way intending to be limiting of the subject being claimed, Applicants' specification, from page 1, line 23 to page 3, line 3, states that:

> ". . in the above-described optical filter, the number of components had to be increased as the intensity of incident light was reduced. Furthermore, with photoreceiving element described in the aforesaid patent application, it is difficult to detect selectively only the UV radiation with a wavelength close to 365 nm. * * * With the aforesaid UV sensor in accordance with the present invention, because the incident light glass formed from borosilicate [formerly Kovar] glass, <u>the light with a wavelength of about 300 nm or larger is selectively transmitted. Furthermore, because the photoabsorption layer of the pin-type photodiode disposed inside the container is formed from $In_xGa_{(1-x)}N$ (0<x<1), the light with a wavelength of about 400 nm or less of the light that was transmitted through the incident light window is selectively photoelectrically converted. Therefore, only the light with a wavelength of about 365 nm can be selectively detected</u>." (Underlining added.)

Thus, the pin-type photodiode comprises:

(P) p-type nitride semiconductor layer;

(I) photoabsorption layer formed from $In_xGa_{(1-x)}N$ ($0<x<1$); and

(N) n-type nitride semiconductor layer.

Accordingly, in accordance with Applicants' disclosure, the energy gap of the photoabsorption layer is smaller than the rest of the nitride layers. This is reflected in the combinations recited in Applicants' claims, e.g., independent claim 1 is directed to a combination wherein each energy gap of the n-type nitride semiconductor layer and p-type nitride semiconductor layer is equal to or larger than the energy gap of the photoabsorption layer.

In contrast with the subject matter recited in Applicants' claims, the applied reference to Kozodoy et al., in the Abstract of that reference, describes a "solar blind p-i-n photodiode where the active i-region has a bandgap of one or both of the n-type and p-type regions. The preferred embodiment photodiode is GaN based and Al is added to the regions to obtain the desired bandgap profiles. Al is added to the i-region to obtain a bandgap large enough to be responsive to light in the solar blind spectrum. By having a smaller bandgap p-type and n-type region, the problems associated with growing highly doped AlGaN are avoided." (Underlining added.)

Thus, the PIN photodiode of Kozodoy et al. comprises:

a p-type GaN region 12;

an i-type thin AlGaN region 16, having a large energy-band gap; and

an n-type GaN substrate 14.

Thus, with reference to Kozodoy et al., Applicants advise that the thin and large energy-band gap AlGaN region suppresses the light absorption in this layer. That is, the active i-region of Kozodoy et al. has a bandgap that is larger than the bandgap of one or both of the n-type and p-type regions. This is very different from the combination recited in Applicants' independent claim 1 comprising a pin-type photodiode and borosilicate glass window, in which

the energy gap of the photoabsorption layer is smaller than the rest of the nitride layers. Thus, not only does Kozodoy et al. not teach or suggest the combination recited in claim 1 wherein "each energy gap of the n-type nitride semiconductor layer and p-type nitride semiconductor layer is equal to or larger than the energy gap of the photoabsorption layer," to the contrary Kodozoy et al. teaches away from this recited combination.

The applied reference to Starikov et al. does not make up for the deficiencies in Kodozoy et al. In this regard, Starikov et al. is alleged to disclose a one-chip micro-integrated opto-electronic sensor. According to Fig. 3 of Starikov et al., an optoelectronic device 30 is disclosed. Moreover, the Examiner asserts that n-type InGaN layer 42 of Starikov et al. is a photoabsorption layer. The energy gap of InGaN (2 to 3.4eV) is smaller than that of GaN (3.4 eV). However, there is no disclosure regarding the use of Kovar (borosilicate) glass in Starikov et al. Thus, Starikov et al., as with Kodozoy et al., most definitely does not anticipate any of Applicants' claimed combinations.

As for the obviousness rejection asserted against the claims by the pending Office Action, Starikov et al. most definitely does not overcome the fact that Kodozoy et al. teaches away from the combination recited in independent claim 1. In this regard, the establishment of a *prima facie* case of obviousness requires a showing of a suggestion or motivation to modify or combine the applied prior art teachings, a reasonable expectation of success, and a teaching or suggestion of each and every claim limitation by the modified prior art reference (or references when combined). M.P.E.P. § 2143, citing *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991). The motivation or suggestion to modify or combine prior art teachings cannot come from the applicant's own disclosure. Instead, the teachings from the prior art itself must

have suggested the claimed subject matter to one of ordinary skill in the art. *In re Rinehart*, 531 F.2d 1048, 1051 (C.C.P.A. 1976).

Applicants submit that the Examiner has not established a *prima facie* case of obviousness in the present case at least because no motivation for the proposed combination is disclosed. And, perhaps more importantly, the Examiner has not established a *prima facie* case of obviousness in the present case at least because the prior art teaches away from the claimed invention. *In re Dow Chemical Co.*, 837 F.2d 469 (Fed. Cir. 1988). As discussed above, not only does Kozodoy et al. not teach or suggest the combination recited in claim 1 wherein "each energy gap of the n-type nitride semiconductor layer and p-type nitride semiconductor layer is equal to or larger than the energy gap of the photoabsorption layer," to the contrary Kodozoy et al. teaches away from this recited combination. For at least this reason, Applicants submit that the the applied references to Kodozoy et al. and Starikov et al., whether taken alone or in combination, do not disclose or suggest the combinations recited in independent claim 1 or its dependent claims 2-4.

Accordingly, reconsideration and withdrawal of the pending rejections based on the prior art are respectfully requested.

CONCLUSION

In view of the foregoing, Applicants submit that the pending claims are in condition for allowance, and respectfully request withdrawal of all outstanding objections and rejection, and request the timely allowance of the pending claims. Should the Examiner feel that there are any issues outstanding after consideration of this response, the Examiner is invited to contact Applicant's undersigned representative to expedite prosecution. A favorable action is awaited.

EXCEPT for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. § 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account No. 50-0573. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. § 1.136(a)(3).

Respectfully submitted,

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By: ______________________

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Dated: April 28, 2006

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3.1.2 Window materials

As stated in the preceding section, most photocathodes have high sensitivity down to the ultraviolet region. However, because ultraviolet radiation tends to be absorbed by the window material, the short wavelength limit is determined by the ultraviolet transmittance of the window material.[19)-22)] The window materials commonly used in photomultiplier tubes are as follows:

(1) MgF_2 crystal

The crystals of alkali halide are superior in transmitting ultraviolet radiation, but have the disadvantage of deliquescence. A magnesium fluoride (MgF_2) crystal is used as a practical window material because it offers very low deliquescence and allows transmission of vacuum ultraviolet radiation down to 115 nanometers.

(2) Sapphire

Sapphire is made of Al_2O_3 crystal and shows an intermediate transmittance between the UV-transmitting glass and synthetic silica in the ultraviolet region. Sapphire glass has a short wavelength cutoff in the neighborhood of 150 nanometers, which is slightly shorter than that of synthetic silica.

(3) Synthetic silica

Synthetic silica transmits ultraviolet radiation down to 160 nanometers and in comparison to fused silica, offers lower absorption in the ultraviolet region. Since silica has a thermal expansion coefficient greatly different from that of a Kovar alloy used for the stem pins (leads) of photomultiplier tubes, it is not suited for use as the bulb stem. Because of this, a borosilicate glass is used for the bulb stem and then a graded seal using glasses with gradually different thermal expansion coefficient are connected to the synthetic silica bulb, as shown in Figure 3-2. Because of this structure, the graded seal is very fragile so that sufficient care should be taken when handling the tube. In addition, helium gas may permeate through the silica bulb and cause the noise to increase. Avoid operating or storing such tubes in environments where helium is present.

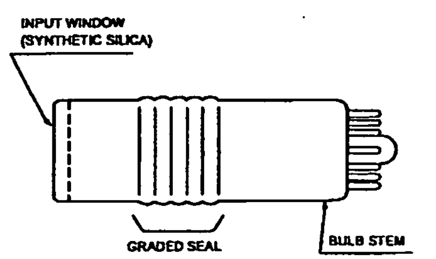

Figure 3-2: Grated seal

(4) UV glass (UV-transmitting glass)

As the name implies, this transmits ultraviolet radiation well. The short wavelength cutoff of the UV glass extends to 185 nanometers.

(5) Borosilicate glass

This is the most commonly used window material. Because the borosilicate glass has a thermal expansion coefficient very close to that of the Kovar alloy which is used for the leads of photomultiplier tubes, it is often called "Kovar glass". The borosilicate glass does not transmit ultraviolet radiation shorter than 300 nanometers. It is not suited for ultraviolet detection shorter than this range. Moreover, some types of head-on photomultiplier tubes using a bialkali photocathode employ a special borosilicate glass (so-called "K-free glass") containing a very small amount of potassium (K^{40}) which may cause unwanted noise counts. The K-free glass is mainly used for photomultiplier tubes designed for scintillation counting where low background counts are desirable. For more details on background noise caused by K^{40}, refer to Section 3.3.6, "Dark current".

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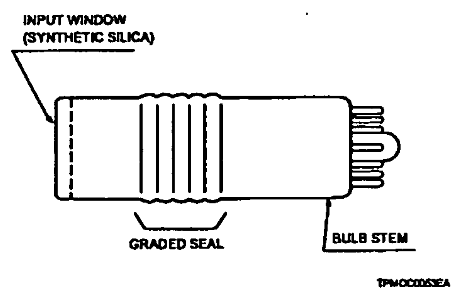

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